

REPORT NO. 500-TRC-08-001 – TRC20060110
ZENN MOTOR COMPANY
NHTSA C81000 - 2008 ZENN 2008

FMVSS 500
LOW SPEED VEHICLES
2008 ZENN 2008, 2-DR. HATCHBACK, LSV
NHTSA C81000

TRANSPORTATION RESEARCH CENTER INC.
East Liberty, Ohio 43319



NOVEMBER 2008
FINAL REPORT

Prepared Under Contract No. DTNH22-06-C-00033

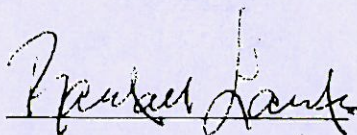
PREPARED FOR:

U.S. DEPARTMENT OF TRANSPORTATION
National Highway Traffic Safety Administration
Enforcement
Office of Vehicle Safety Compliance
1200 New Jersey Avenue S.E.
West Building 4th Floor
OVSC (NVS-221)
Washington, D.C. 20590

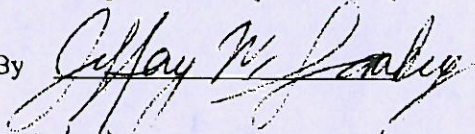
Prepared for the Department of Transportation, National Highway Traffic Safety Administration, under Contract No. DTNH22-06-C-00033.

This publication is distributed by the U.S. Department of Transportation, National Highway Traffic Safety Administration, in the interest of information exchange. The opinions, findings and conclusions expressed in this publication are those of the author(s) and not necessarily those of the Department of Transportation or the National Highway Traffic Safety Administration. The United States Government assumes no liability for its contents or use thereof. If trade or manufacturers' names or products are mentioned, it is only because they are considered essential to the object of the publication and should not be construed as an endorsement. The United States Government does not endorse products of manufacturers.

Prepared By



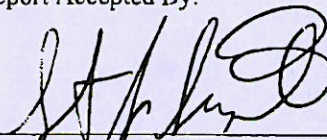
Approved By



Date:

11/11/08

Report Accepted By:



Contract Technical Manager, Office of
Vehicle Safety Compliance

11/17/08

Date

TECHNICAL REPORT STANDARD TITLE PAGE

1. Report No. 500-TRC-08-001	2. Government Accession No.	3. Recipient's Catalog No.	
4. Title and Subtitle Final report of FMVSS 500 Compliance Testing of 2008 Zenn 2008, NHTSA No. C81000		5. Report Date November 2008	
		6. Performing Organization Code TRC 20060110/8500	
7. Author(s) Alan Ida, Project Engineer Randy Landes, Engineering Technician		8. Performing Organization Report No. 500-TRC-08-001	
9. Performing Organization Name and Address Transportation Research Center Inc. 10820 State Route 347 East Liberty, OH 43319		10. Work Unit No.	
		11. Contract or Grant No. DTNH22-06-C-00033	
12. Sponsoring Agency Name and Address U.S. Department of Transportation National Highway Traffic Safety Administration Enforcement Office of Vehicle Safety Compliance (NVS-221) 1200 New Jersey Avenue, S.E. West Wing 4 th Floor Washington, D.C. 20590		13. Type of Report and Period Covered Final test report October 29, 2008 to November 7, 2008	
		14. Sponsoring Agency Code NVS-221	
15. Supplementary Notes			
16. Abstract Compliance tests were conducted on the subject 2008 Zenn 2008 in accordance with the specifications of the Office of Vehicle Safety Compliance Test Procedure No. TP-500-02 for the determination of FMVSS 500 compliance. Test failures identified were as follows: None.			
17. Key Words Compliance Testing Safety Engineering FMVSS 500		18. Distribution Statement Copies of this report are available from: NHTSA Technical Reference Division NPO-411 1200 New Jersey Avenue Washington, D.C. 20590 Email: tis@nhtsa.dot.gov Fax No.: (202) 493-2833	
19. Security Classif. (of this report)	20. Security Classif. (of this page)	21. No. of Pages 45	22. Price

TABLE OF CONTENTS

<u>SECTION</u>	<u>TITLE</u>	<u>PAGE</u>
	Notice	i
	Table of Contents	iii
1.0	Purpose of Compliance Test	1
2.0	Vehicle Information and Summary Sheet	2
3.0	Compliance Test Data Sheets	3
4.0	Noncompliance Data	9
5.0	Photographs	10
6.0	Test Equipment List and Calibration Information	30
Appendix A	Contractor's Comments, Procedure Modifications and Test Facility	32
Appendix B	Test Speed Graphs	35
Appendix C	Copy of Manufacturer's Sticker	38
Appendix D	Pertinent Owner's Manual Pages	40

1.0 PURPOSE OF COMPLINACE TEST

Tests were conducted on a 2008 Zenn 2008, 2-dr. hatchback, LSV to determine compliance with FMVSS 500 "Low Speed Vehicles."

All tests were conducted in accordance with the U.S. DOT, NHTSA Laboratory Procedure TP- 500-02 and/or the corresponding Transportation Research Center Inc. (TRC Inc.) test procedure, which was submitted to NHTSA for their approval. The test procedure was clearly described in the submitted document and has not been repeated in this report.

All stops were performed manually.

TRC Inc. personnel using the following TRC facilities conducted all tests:

Skid Pad
Speed Test

Average PFC during the test period was 0.96 (Skid Pad) utilizing the ASTM E1337 w/E1336 tire method.

The test vehicle met all the requirements of FMVSS 500.

2.0 FMVSS 500 – LSV INFORMATION AND TEST DATA SUMMARY

TEST LAB: TRC Inc.

CONTRACT No.: DTNH22-06-C-00033

TEST START DATE: 10/24/08

TEST END DATE: 11/03/08

TEST START ODO.: 92 km

TEST END ODO.: 135 km

VEHICLE MAKE/MODEL/YEAR: Zenn 2008, 2008

PROPULSION TYPE: Battery Powered Electric Motor – FWD SEATING CAPACITY: 2

GVWR: 819.6 kg GAWR FRONT: 369.7 kg GAWR REAR: 450.0 kg

DEALER INSTALLED ACCESSORIES: N/A

TIRE MAKE/MODEL/TYPE & SIZE: Kléber, Viaxer, Steel Belt Radial, 145/70R13 71T

Safety Equipment	Pass	Fail
Headlamps (S5(b)(1))	X	
Turn signal lamps, front and rear (S5(b)(2))	X	
Tail lamps (S5(b)(3))	X	
Stop lamps (S5(b)(4))	X	
Reflex reflectors, one red on each side, one on rear (S5(b)(5))	X	
Driver's side exterior mirror or interior mirror (S5(b)(6))	X	
Passenger's side exterior mirror or interior mirror(S5(b)(6))	X	
Parking brake (S5(b)(7))	X	
Windshield, AS-1 or AS-4 composition (S5(b)(8))	X	
Vehicle Identification Number [VIN] (S5(b)(9))	X	
Seat belt assemblies – Type 1 or 2 (S5(b)(10))	X	
Certification label (Part 567)	X	
Vehicle Loading	Pass	Fail
Certification Label GVWR < 1,361 kg.	X	
With Occupant Weight Added to UVW: GVWR ≥ total measured vehicle weight. GVWR ≥ measured axle weights.	X	
With Occupant, Cargo &Luggage Weight Added to UVW: GVWR ≥ total measured vehicle weight. GVWR ≥ measured axle weights.	X	
Maximum Speed Test	Pass	Fail
Maximum Speed (S5(a)): <u>41.8</u> km/hr (more than 32 km/hr and not more than 40 km/hr)	X*	

Comments: *See Appendix A.

3.0 FMVSS 500 – DATA SHEET 1 (Sheet 1 of 2)

VISUAL INSPECTION

VEHICLE MAKE/MODEL/YEAR: Zenn 2008, 2008

TEST/INSPECTION DATE: 10/24/08 VEHICLE ODO: 95 km

NHTSA No.: C81000

Headlamps: [Requirement: Must be present.]

Method of Activation: Rotate two position switch on the end of a stalk at the left side of the steering wheel. Pull stalk toward driver for High-beams.

Function (Yes/No): Yes.

Turn Signals: [Requirement: Front and Rear must be present.]

Description (color and location): Front: Amber and immediately adjacent to the headlamps. Rear: Amber and at rear edges at approx. vehicle mid-height.

Method of Activation: Push up for right and pull down for left - stalk on left side of steering wheel. Also, pushing in the "Emergency Flasher" button.

Function (Yes/No): Yes. Self cancelling feature (Yes/No): Yes.

Tail Lamps: [Requirement: Must be present.]

Description (Lens color): Red.

Method of Activation: First and second position of the rotary switch on the stalk on the left side of steering wheel.

Function (Yes/No): Yes.

Stop Lamps: [Requirement: Must be present.]

Description (Lens color): Red.

Method of Activation: Application of the service brake.

Function (Yes/No): Yes.

Reflex Reflectors: [Requirement: One red on each side as far to the rear as practicable, and one red on the rear.]

Description (Color, material, shape): Sides: Red, reflective tape, 25 x 215 mm – curved. Rear: Red, reflective lens, 20 x 200 mm.

Location: Sides: Forward edge (sides) of rear tail lamp assemblies. Rear: Lower portion of rear fascia.

Mirrors: [Requirement: Exterior driver's side mirror and either an exterior passenger side mirror or an interior mirror.]

Description (Flat or convex): Driver's side: Convex, Passenger's side: Flat.

FMVSS 500 – DATA SHEET 1 (Sheet 2 of 2)

VISUAL INSPECTION

Location: Interior mirror affixed to windshield. Exterior: Forward edge of doors.
Method for Adjustment: Lever inside vehicle for each exterior mirror.

Parking Brake: [Requirement: Must be present.]

Description (Type): Spring loaded lever acting on rear service brake pads.

Location: Activation control between front seats.

Method of Activation and Release: Pull up/back on lever to activate and depress button on end of lever to release.

Function (Yes/No): Yes.

Windshield: [Requirement: Must meet the ANSI/SAE Z26.1 – 1996 specifications for AS-1 or AS-4 glazing and be marked with “DOT”, manufacturer, and “AS-1” or “AS-4”. Conformance to FMVSS 205.]

Labeling: INDUVER, “E2” within circle, Laminated Safety Glass, 43-R-007042, DOT 759 AS1 M521, “82” within square, 007042, 8, Tinted

Vehicle Identification Number (VIN): [Requirement: A VIN that conforms to the requirements of Part 565 – Vehicle Identification Number including 17 digit alpha- numeric number.]

Location: Extreme left, top edge of windshield, near roof.

Seatbelt: [Requirement; Type 1 or Type 2 belts conforming to FMVSS 209.]

Type: Three point, Labeling: Type 2, Conforms to FMVSS 209 &302.

Labeling: Part No. 70-1601-04, 70-1601-05, MFG. 2007, AMSAFE No. 000058.

Location: At each belt’s anchor point.

Certification Label: [Requirement: Complies with Part 567 Certification.]

Vehicle Type Identified on Label: Low Speed Vehicle.

Location: Lower portion of the driver’s side B-pillar door post.

Certification Statement (Yes/No): Yes.

Comments: None.

DATA INDICATES COMPLIANCE: YES: X No:

RECORDED BY: R. Landes

DATE: 11/07/08

APPROVED BY: J. Sankey

DATE: 11/11/08

FMVSS 500 – DATA SHEET 2 (Sheet 1 of 1)

VEHICLE LOADING

VEHICLE MAKE/MODEL/YEAR: Zenn 2008, 2008

TEST/INSPECTION DATE: 10/24/08 VEHICLE ODO: 95 km

NHTSA No.: C81000

Information from vehicle certification label"

GVWR: 819.6* kg; 1807 lb, GAWR F: 369.7* kg; 815 lb, GAWR R: 450.0* kg; 992 lb

Number of seat belt assemblies = designated seating capacity (DSC): 2

Vehicle weight measurements:

Unloaded Vehicle Weight: Vehicle 610.4 kg or sum (front + rear) NA kg

Front 308.0 kg, Rear 302.4 kg

Includes maximum capacity of fluids necessary for operation of the vehicle; state fluids and amounts added, if any: NA

Vehicle plus occupants weight = DSC 2 x 68 kg = 136 kg

Vehicle 748.6 kg or sum (front + rear) NA kg, Front 379.6 kg, Rear 369.0 kg

Cargo and Luggage Weight (if specified) = NA kg – occupant weight NA kg = NA kg

Source: () label on vehicle, () owner's manual, () other: None specified.

Recommended location (if specified): NA

Source: () label on vehicle, () owner's manual, () other: None specified.

Vehicle plus occupants, cargo and luggage weight = Vehicle 748.6 or sum (front + rear) NA kg, Front 379.6 kg, Rear 369.0 kg

Contact COTR if any vehicle weight (or sum of axle weights) exceeds GVWR or if a front or rear axle load exceeds a GAWR.

If no cargo and luggage weight or vehicle capacity weight is specified, then calculate the following:

Cargo and luggage weight = GVWR 819.6 kg – vehicle plus occupants weight 748.6 kg (from above) = 71.0 kg.

Comments: *Calculated conversion values – placard in pounds. No cargo/luggage values specified by manufacturer.

DATA INDICATES COMPLIANCE: YES: X No: _____

RECORDED BY: K. Easterday

DATE: 10/24/08

APPROVED BY: R. Landes

DATE: 1/10/08

FMVSS 500 – DATA SHEET 3 (Sheet 1 of 1)

VEHICLE LOADING

VEHICLE MAKE/MODEL/YEAR: Zenn 2008, 2008

TEST/INSPECTION DATE: 10/24/08 VEHICLE ODO: 95 km

NHTSA No.: C81000

Unloaded Vehicle Weight (UVW):

LF Wheel 160.0 kg RF Wheel 148.0 kg Front Axle 308.0 kg
LR Wheel 143.4 kg RR Wheel 159.0 kg Rear Axle 302.4 kg

Weight of Driver, Instrumentation and Required Ballast: 83.0 kg (78 – 90 kg)

Vehicle Test Weight (UVW = weight of driver instrumentation and required ballast):

LF Wheel 184.8 kg RF Wheel 161.4 kg Front Axle 346.2 kg
LR Wheel 184.4 kg RR Wheel 162.6 kg Rear Axle 347.0 kg
Total Vehicle 693.2 kg

Actual Tire Inflation Pressure: LF 351.6 kPa, RF 351.6 kPa, LR 351.6 kPa, RR 351.6 kPa

Maximum Tire Inflation Pressure from Tire Sidewall: Front 351.6 kPa, Rear 351.6 kPa

Vehicle Break-in Agenda Specified by Vehicle Manufacturer: () Yes, (X) No.

If Yes, Describe: NA

Data Acquisition System, Field Calibration “Distance” – Pre Test

	Check No. 1 (meters)	Check No. 2 (meters)
Known Distance:	1000	1000
Measure Distance” [Allowed Tolerance \pm 2 meters]	999.98 South	1000.03 North

Vehicle Conditioning: Start Time 6:00 End Time 9:00 Duration 17 min. (3 hr. min.)

Start Temp 5.6°C End Temp 8.9°C

Vehicle conditioned within 5°C of ambient: (X) Yes, () No

Propulsion Batteries Fully Charged: () Yes, (X) No

Comments: Vehicle Conditioning occurred during the a.m. of 10/31/08.

DATA INDICATES COMPLIANCE: YES: X No: _____

RECORDED BY: K. Easterday

DATE: 10/29/08

APPROVED BY: R. Landes

DATE: 11/10/08

FMVSS 500 – DATA SHEET 4 (Sheet 1 of 2)

SPEED TEST

VEHICLE MAKE/MODEL/YEAR: Zenn 2008, 2008

TEST/INSPECTION DATE: 10/31/08 VEHICLE ODO: 123.9 km

NHTSA No.: C81000

Conditioning Temperature Range (see Data Sheet 3): 7.8 to 10.0 °C

Ambient Temperature: Pass 1 9.4°C, delta 2.8° C Pass 2 10.0°C, delta 3.2° C
(delta = Conditioning Temperature minus Ambient Temperature)

Maximum Wind Speed: Pass 1 2.7 m/s Pass 2 4.9 m/s

Description of Vehicle Openings: All potential vehicle opening s were closed.

Vehicle Odometer and/or Hour Meter reading: 123.9 to 127.1 km

Start Time: Pass 1 9:21 End Time: Pass 1 9:24
Pass 2 9:28 Pass 2 9:31

Vehicle Charge Level Meter, % (if applicable): Start: Pass 1 100 End: Pass 1 100
Start: Pass 2 100 End: Pass 2 100

Measured Battery Voltage, "V" (if applicable): Start: Pass 1 NA End: Pass 1 NA
(Test laboratory measured with voltmeter) Start: Pass 2 NA End: Pass 2 NA

Maximum Vehicle Speed Data

Pass	Maximum Speed Visual Data (km/hr)	Maximum Speed Recorded Data (km/hr)	Time Between Passes (minutes) (30 max.)
Pass #1 (1 st 1.6 km)	41.658	41.497	4 min.
Pass #2 (2nd 1.6 km)	41.740	41.740	

NOTE: Vehicle speed and distances versus time data traces for each speed run are to be included in the final test report. See Appendix A.

Comments: Battery voltage was not measured.

DATA INDICATES COMPLIANCE: YES: X No:

RECORDED BY: K. Easterday

DATE: 10/31/08

APPROVED BY: R. Landes

DATE: 11/10/08

FMVSS 500 – DATA SHEET 4 (Sheet 2 of 2)

SPEED TEST – Post Test

VEHICLE MAKE/MODEL/YEAR: Zenn 2008, 2008

TEST/INSPECTION DATE: 10/31/08 VEHICLE ODO: 135.2 km

NHTSA No.: C81000

Data Acquisition System, Field Calibration “Distance” – Post Test

	Check No. 1 (meters)	Check No. 2 (meters)
Known Distance:	1000	1000
Measure Distance” [Allowed Tolerance \pm 2 meters]	999.37 South	1001.09 North

Data Acquisition System, Field Calibration “Time” – Post Test [Traverse Known 1000 meter Distance at Constant Speed of 32 km/h (20 mi/h) \pm 1.6 km/h (1 mi/h)]

	Check No. 1 (seconds)	Check No. 2 (seconds)
Known Time:	112	112
Measure Distance” [Allowed Tolerance \pm 1 seconds]	112.28	112.93

Comments: None.

DATA INDICATES COMPLIANCE: YES: X No:

RECORDED BY: K. Easterday

DATE: 10/31/08

APPROVED BY: R. Landes

DATE: 11/10/08

4.0 NOTICE OF NONCOMPLIANCE

Not applicable -

This vehicle (C81000) met the compliance standards.

5.0 PHOTOGRAPHS

2008 Zenn 2008, 2-Dr., Hatchback
NHTSA No. C81000
November 2008

11



Left Front 3/4 View

2008 Zenn 2008, 2-Dr., Hatchback
NHTSA No. C81000
November 2008

12



Right Rear 3/4 View

Mfd By ZENN MOTOR Co.

07/08

GVWR 1807 LB

GAWR FRONT 815 LB

REAR 992 LB

THIS VEHICLE CONFIRMS TO ALL APPLICABLE U.S.
FEDERAL MOTOR VEHICLE SAFETY STANDARDS IN
EFFECT ON THE DATE OF MANUFACTURE SHOWN
ABOVE

VIN 2FHAS15A18S001083

LOW SPEED VEHICLE

2008 Zenn 2008, 2-Dr., Hatchback
NHTSA No. C81000
November 2008



Vehicle Certification Placard

2008 Zenn 2008, 2-Dr., Hatchback
NHTSA No. C81000
November 2008

TIRE	SIZE	COLD TIRE PRESSURE
FRONT	P145/70/13	30 PSI
REAR	P145/70/13	30 PSI
SPARE	NONE	

**SEE OWNER'S
MANUAL FOR
ADDITIONAL
INFORMATION**

MADE BY ZENN MOTOR CO.
GVWR 1507 LB
GAWR FRONT 815 LB
REAR 692 LB
THIS VEHICLE CONFORMS TO ALL APPLICABLE U.S.
FEDERAL MOTOR VEHICLE SAFETY STANDARDS IN
EFFECT ON THE DATE OF MANUFACTURE.

Vehicle Tire Information Label

2008 Zenn 2008, 2-Dr., Hatchback
NHTSA No. C81000
November 2008

15



Instrumentation in Vehicle

2008 Zenn 2008, 2-Dr., Hatchback
NHTSA No. C81000
November 2008

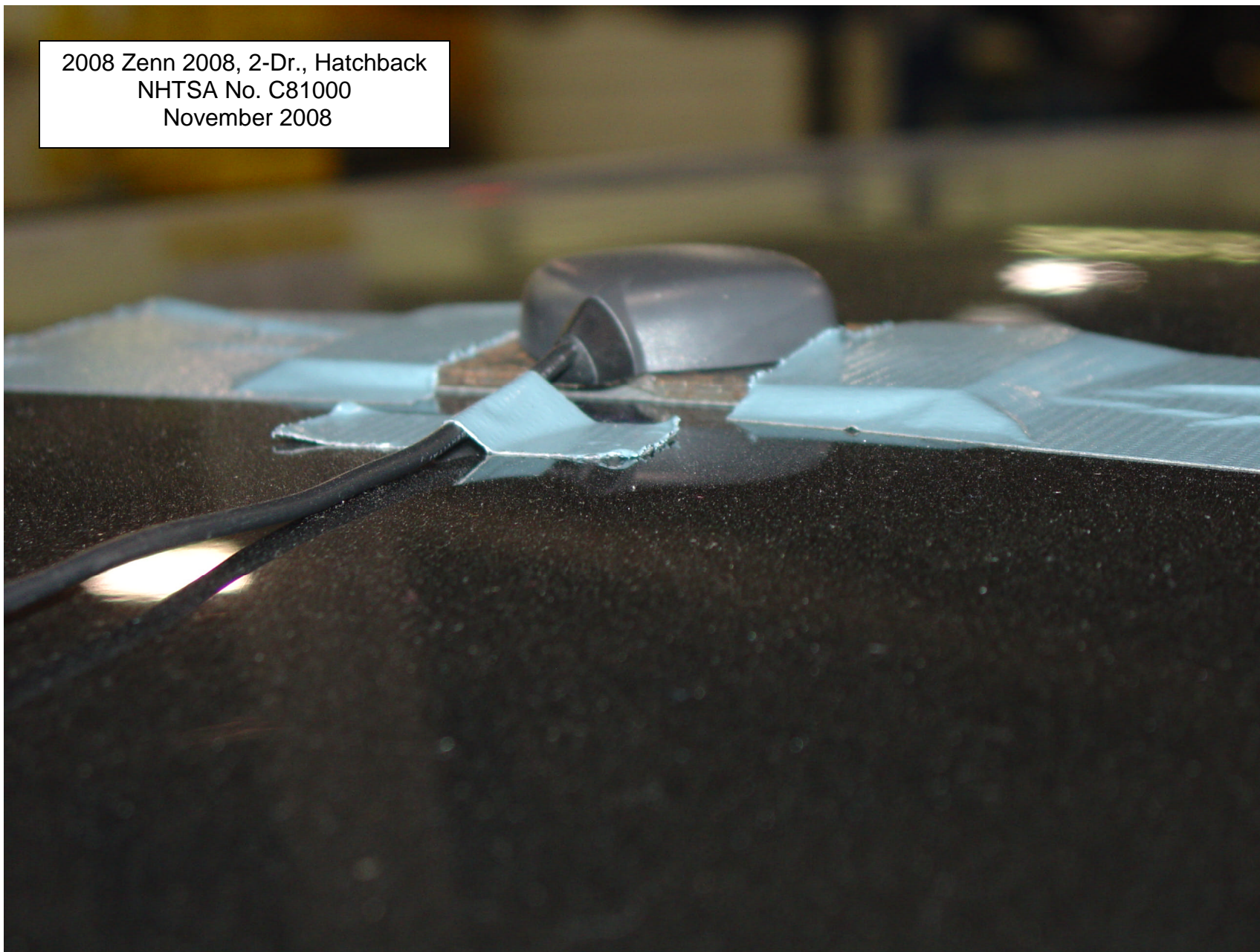
16



Instrumentation in Vehicle

2008 Zenn 2008, 2-Dr., Hatchback
NHTSA No. C81000
November 2008

17



Instrumentation on Vehicle

2008 Zenn 2008, 2-Dr., Hatchback
NHTSA No. C81000
November 2008



WARNING

**FAILURE TO FOLLOW
THESE WARNINGS
COULD RESULT IN
SERIOUS OR FATAL
INJURY**

WARNINGS

Before operating this vehicle read your Owner's Manual completely

This vehicle has a maximum speed of 25 mph

Your vehicle is battery powered. Handled improperly, batteries can be dangerous

To reduce the risks of electrical shock, refer servicing to qualified service personnel

Do not operate this vehicle under the influence of alcohol, drugs or medication

This vehicle shall not be operated on a public highway with a speed limit in excess of 35 mph

Do not impede traffic with this vehicle as it may create a hazard to others and may be subject to driver citations for impeding traffic in some jurisdictions.

Check with your local law enforcement (city, county and state) for variations to low speed vehicle laws

2008 Zenn 2008, 2-Dr., Hatchback
NHTSA No. C81000
November 2008

19



Vehicle Being Weighed

2008 Zenn 2008, 2-Dr., Hatchback
NHTSA No. C81000
November 2008

20



Front Headlamp, Running Lamp, Turn Signal and Reflector (typical)

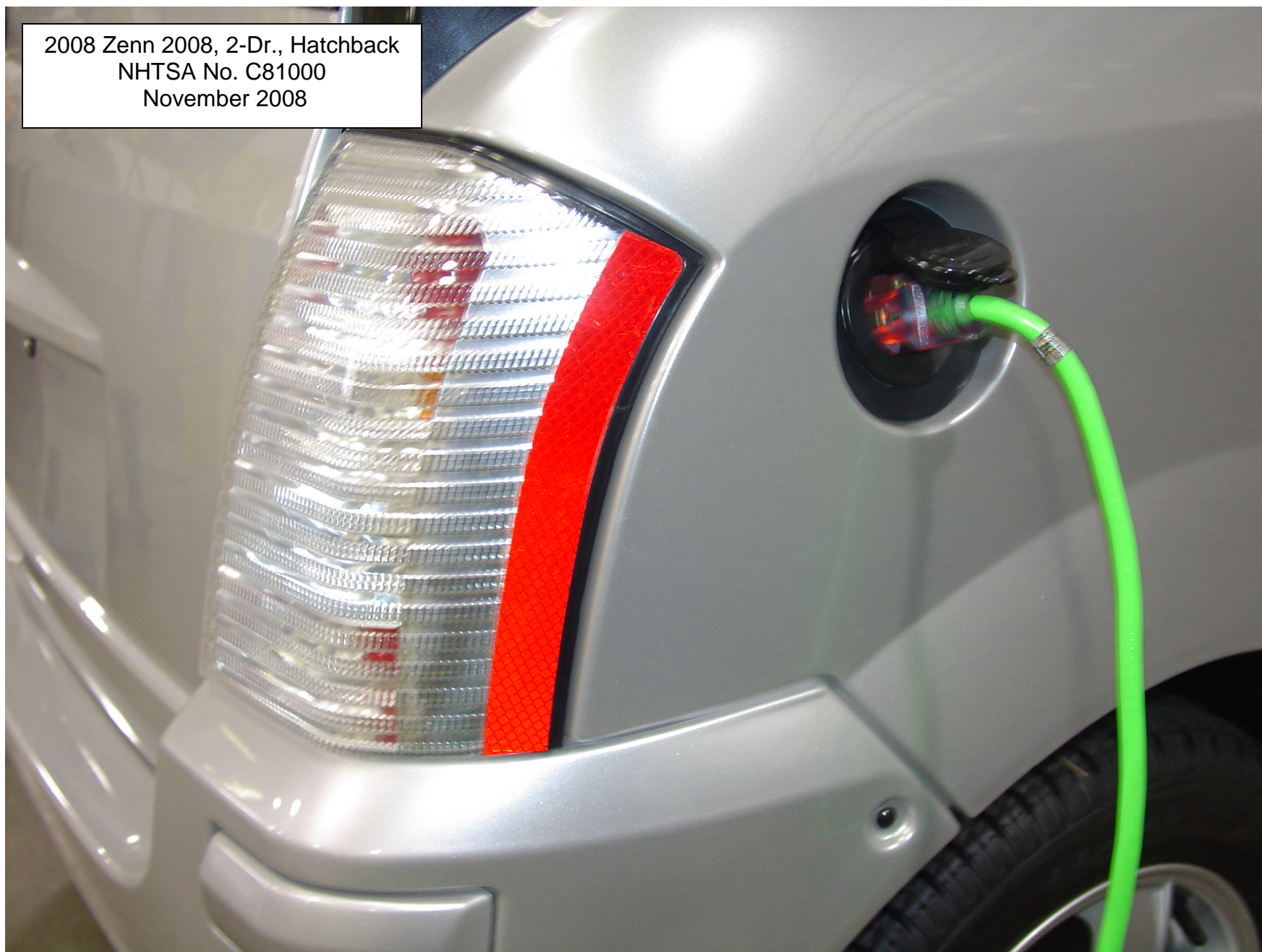
2008 Zenn 2008, 2-Dr., Hatchback
NHTSA No. C81000
November 2008

21



Rear Brake Lamp, Running Lamp, Backup Lamp and Reflector (typical)

2008 Zenn 2008, 2-Dr., Hatchback
NHTSA No. C81000
November 2008



Rear Side Reflector (typical)

2008 Zenn 2008, 2-Dr., Hatchback
NHTSA No. C81000
November 2008



Driver's (Left Side) Mirror

2008 Zenn 2008, 2-Dr., Hatchback
NHTSA No. C81000
November 2008

24



Passenger's (Right Side) Mirror

2008 Zenn 2008, 2-Dr., Hatchback
NHTSA No. C81000
November 2008

25



Parking Brake Control

2008 Zenn 2008, 2-Dr., Hatchback
NHTSA No. C81000
November 2008

11
E2 **INDUVER**
Laminated safety glass
43R -007042
DOT 759 AS1 M521
e2 007042
..... 8
Tinted

Windshield Labeling Conformance to FMVSS 205

2008 Zenn 2008, 2-Dr., Hatchback
NHTSA No. C81000
November 2008

2FHAS15A18S001083

Windshield VIN – Upper Left-hand Corner

2008 Zenn 2008, 2-Dr., Hatchback
NHTSA No. C81000
November 2008

28

SAFETY SEAT
BELT CONFORMS TO:
FMVSS NO.209 & 302

TYPE: 3 POINT
PART No.
70 1501 04

Seat Belt Labeling (Driver's Side) – Conformance to FMVSS 209 (typical)

2008 Zenn 2008, 2-Dr., Hatchback
NHTSA No. C81000
November 2008

29



Seat Belt Labeling (Driver's Side) – Conformance to FMVSS 209 (typical)

6.0 TEST EQUIPMENT LIST AND CALIBRATION INFORMATION

INSTRUMENT CALIBRATION (12 MONTH MAXIMUM INTERVAL)

VEHICLE: 2008 Zenn, 2008

NHTSA No.: C81000

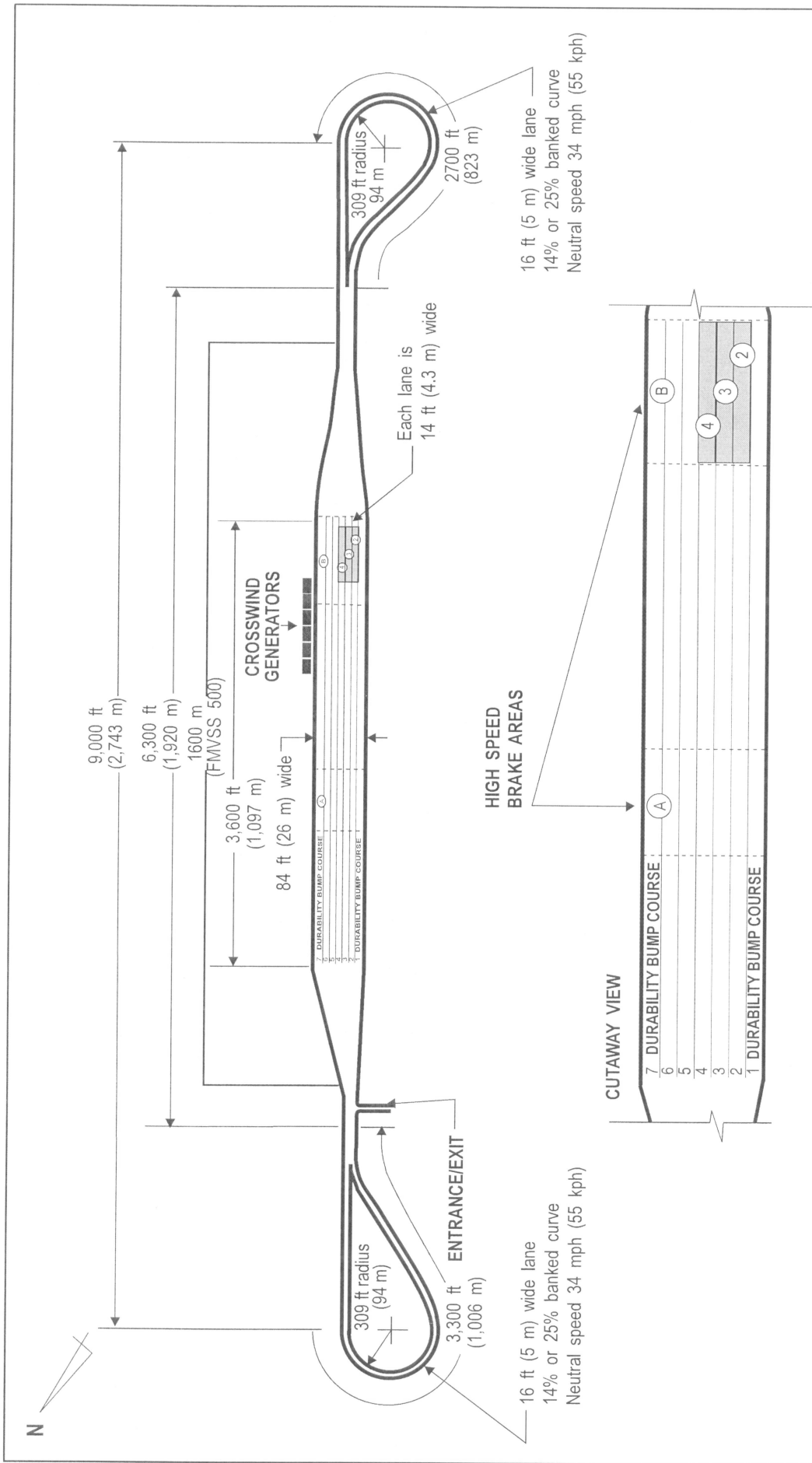
DATE: 11/10/08

Instrument Use & Manufacturer	Model No.	Serial No.	Range & Resolution	Accuracy	Calibration Date	Next Calibration	Calibrations: Manufacturer, Internal or Contractor
Velocity - Racelogic, LTD	VBOX III 100 Hz	030525	0.1 - 1609 km/h 0.01 km/h	0.1 km/h full scale	02/12/08	02/12/09	Manufacturer
Distance - Racelogic, LTD	VBOX III 100 Hz	030525	Range: NA 1 cm	0.05%	02/12/08	02/12/09	Manufacturer
Voltage – Fluke Corporation	77 III Multimeter	8593001	0 – 320 VDC	± 0.3 % + 1 digit	10/16/08	10/16/09	Internal
Temperature – Davis Instruments	6152 Wireless Vantage Pro ISS	050608N02	-40 °C to 60 °C, 1 °C	± 1 °C, between -40 °C – 43 °C	07/13/08	07/13/09	Manufacturer
Wind Speed – Davis Instruments	6410 Anemometer w/7903L “Large Wind Cups	050608N22	3 to 241 km/h 1 km/h	3 km/h or 5% whichever greater	07/13/08	07/13/09	Manufacturer
Tire Pressure – WIKA Instrument Corporation	Type 233.53 Fluid Filled, Bourdon Tube Pressure Gauge, Stainless S.	TRC SN 101	0 – 410 kPa 3 kPa	1% of Span	09/29/08	12/29/08	Internal
Vehicle Mass – Mettler-Toledo	Four – #2158 Pads/Sensors One – JXGAA00000 Processor/Display	11079361JC 11079461JC 11079471JC 11079381JC 522588315J C	0 TO 1334 KG 0.2 KG	0.1% of Applied Load	08/06/08	11/06/08	Contractor

APPENDIX A

CONTRACTOR'S COMMENTS PROCEDURE MODIFICATIONS TEST FACILITY

While accelerating to speed, the test vehicle momentarily exceeded the maximum allowable speed value during both test runs. It is estimated that the controller took a moment to recognize the maximum speed value and readjust the motor. Once adjusted, the vehicle speed was very stable throughout the remainder of each of the two runs. This adjusted speed was very slightly above (approx. 40.4 km/h) the maximum allowable value. This value is likely within manufacturing tolerances.



Not to Scale

GVW for Lane 1 and 7 (Asphalt Lanes) = 8,000 lbs (3,636 kgs)

GVW for All Other Lanes (Concrete Lanes) = 80,000 lbs (36,364 kgs)

All Concrete Broomed Surface

1 Lap (Including Loops) = Approximately 4 mi (6.4 klm)

SKID PAD

TRC

TRANSPORTATION RESEARCH CENTER INC.

EAST LIBERTY, OHIO 43319-0367

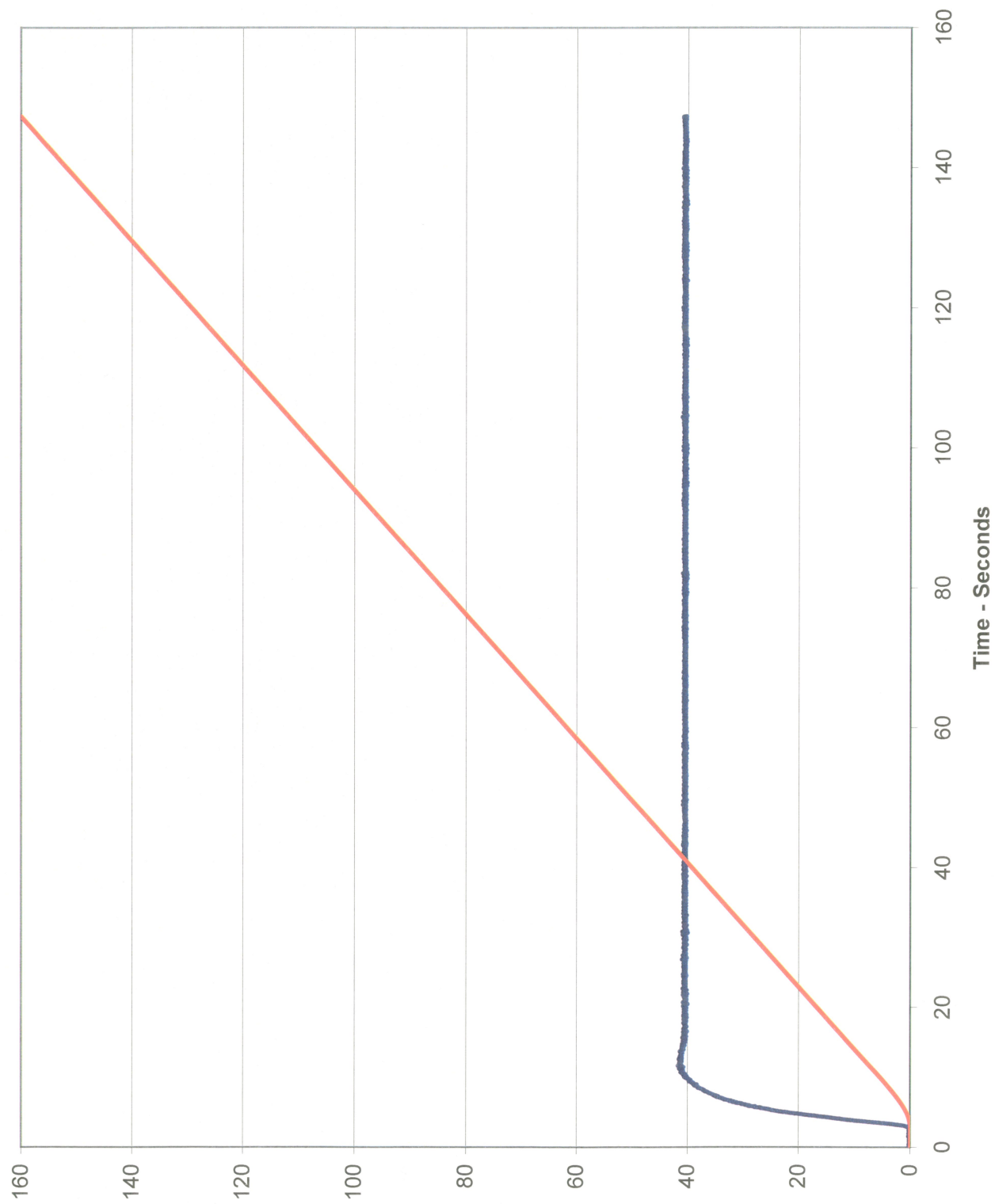
www.trcpg.com

F-13 0308

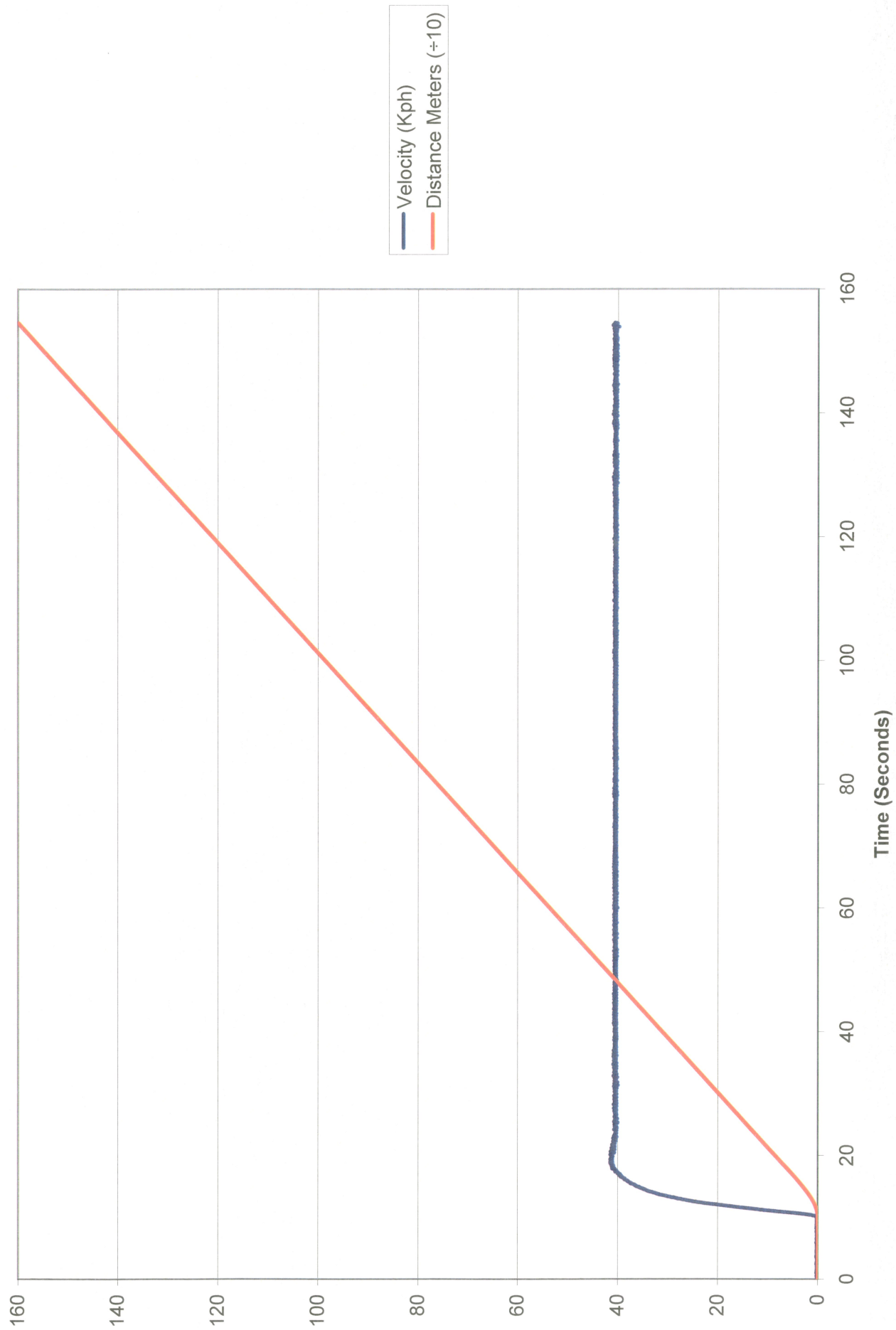
APPENDIX B

TEST SPEED GRAPHS

Zenn C81000, Test Run #2 - North



Zenn C81000, Test Run #1 - South



APPENDIX C
COPY OF MANUFACTURER'S STICKER



ZENN MOTOR COMPANY

MANUFACTURER'S SUGGESTED RETAIL PRICE \$15,995.00

OPTIONAL EQUIPMENT

The New Vehicle Limited Warranty provides comprehensive coverage against defects in material and or workmanship for a period of one (1) year or 5,000 miles. See Owner's Manual for complete details.

Pre-delivery service, licenses and title fees, applicable, federal state and local taxes and retailer-installed options and accessories are not included in the manufacturer's suggested retail price.

DESCRIPTION
 ZENN
 3 Door Hatchback
 Zero Emission, No Noise
 100% Electric Powered

YEAR/MODEL 2008 / ZENN 2008
COLOR: Silver
VIN: 2FHAS15A18S001083
PORT/PLANT: St. Jerome, QC

MECHANICAL & PERFORMANCE

- Front wheel drive
- Helical gear transmission for quiet operation
- 100% electrically driven, 72 VDC (5.69kw)
- Electronic drive-by-wire throttle
- Advanced Motors & Drives, 3 Phase AC drive motor (Length: 10.5", Diameter: 7.5")
- Curtis Motor Controller
- Transmission 10.3 - 1 Speed reducer with integral differential
- Speed control - 300A
- Zero emission vehicle
- Constant velocity driveshaft with CV joints
- Batteries
 - EV31A-A Discover battery pack - 6 x 12V x AGM maintenance free, valve sealed lead acid batteries
- Charging:
 - Approx. 8 hours (110 Volt Standard Electrical Outlet), 80% rechargeable in 4 hours (from empty)
- Independent front wheel suspension with two coil spring/shock units
- Rear suspension - trailing arm with two coil spring/shock units
- Rack and pinion steering
- 13" spoke aluminum magwheels
- 145/70R13 tires

SAFETY

- Adjustable headrests (2 seats)
- 3 Point Seatbelts
- Dual hydraulic system, 4-wheel disc, 6.7 in.
- Electromagnetic regenerative braking
- Black aluminum alloy Space Frame
- Meets FMVSS500 standards

STANDARD EQUIPMENT

EXTERIOR

- Front windshield wipers
- Rear window wiper
- Central antenna
- ABS body panels
- Chrome Grill insert
- Headlights
- Dual exterior mirrors
- Protective color-keyed body moldings
- Black roof and body pillars

COMFORT AND CONVENIENCE

- Adjustable bucket seats
- Two-tone cloth seats
- Power windows
- Rear window defrost
- Interior heating
- Directional Shifter
- Electronic dashboard
- Trip odometer
- Carpeting
- Digital Clock
- Remote keyless entry and locks
- 12V accessory plug
- Central interior light with auto on/off with door opening
- Sun visors
- Integrated locking glove box
- Inside rear trunk pockets
- Storage capacity: approximately 13 cu. ft.

DELIVERY \$1,250.00

TOTAL MSRP \$17,245.00

DEALER NAME / ADDRESS

North Central ZENN
 20 Main Street South
 New London, OH 44851

CITY MPG¹

245



HIGHWAY MPG²

N/A

¹ 100% Electric, the ZENN doesn't use any gasoline. A gallon of gas has an energy equivalent of 33.5 kWh². One gallon of gas provides the same energy as fully charging the ZENN about 7 times. This is an equivalent fuel economy of 7 x 40 miles = 280 mpg (¹ National Association of Fleet Administrators, www.nafa.org)

Estimated Annual Fuel Cost: \$210
 (Calculated at 40 miles/day & 10.3¢/kWh residential electrical rate)

Actual Mileage will vary with the options, driving conditions, temperature, driving habits and vehicle's condition.

² The ZENN is designed for urban transportation and has a regulated maximum speed. It is not approved for highway use.

For Comparison Shopping:
 2008 small vehicles are rated at 29 mpg or less (city) 2008 hybrid small car at 40 mpg (city)
 Source: US DOE, www.fueleconomy.gov

APPENDIX D

PERTINENT OWNER'S MANUAL PAGES

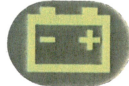
CHARGER STATUS INDICATOR

Maintaining a charge in your batteries will extend their life.

- If the Charger Status Indicator displays short GREEN flashes (1/4 second), the charge is under 80 percent.
- If the Charger Status Indicator displays long GREEN flashes (1/2 second), the charge is more than 80 percent.
- If the Charge Status Indicator is solid green, the charge is complete and you have maximum driving range.



Charge the batteries at any opportunity. Opportunity Charging will extend the life of your batteries. It is always better to recharge as soon as possible after a drive, particularly a long drive.



OVERLOADING

VEHICLE LOAD WEIGHT: *The gross axle weight rating (GAWR) and the gross vehicle weight rating (GVWR) of your vehicle are on the Motor Vehicle Safety Standard Label on the driver's door frame. Exceeding these ratings can cause an accident or vehicle damage. You can estimate the weight of your load by weighing the items (or people) before driving the vehicle.*

Be careful not to overload your vehicle.



Do not operate the charger..

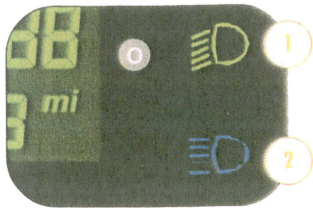
- *if your power cord is cut or damaged. Replace immediately.*
- *if your extension cord is not of the proper gauge and length as described on page 10.*
- *if your ZENN is near fuels, grain dust, solvents, thinners or other inflammables. Chargers can ignite flammable materials and vapors.*
- *if the battery charge port (AC inlet) is damaged.*
- *when the plug is too loose or does not make a good connection.*
- *when the plug blades or contacts are bent or corroded.*
- *when the plug, receptacle or cords are cut, worn, have any exposed wires, or are damaged in any way.*



SERVICE LIGHT

If the Service icon is lit, contact your authorized ZENN retailer.

HEADLIGHT LOW/HIGH BEAM INDICATOR LIGHT



1. Low beam light 2. High beam light

These lights indicate two things:

1. The low beam headlights are on.
2. The high beam headlights are on.

BEEPER

BACKUP ALARM

When the vehicle is in R (Reverse), an audible alarm sounds to alert the driver and pedestrians.

BATTERY ALARM

If the battery charge is very low (the Battery Level Indicator displays only one bar), a battery alarm will sound as a reminder to plug in your vehicle to recharge the batteries.

PARKING BRAKE REMINDER

When you want to drive, the parking brake must be released, otherwise a continuous audible alarm will sound if the Ignition Switch is in the M position and directional shifter is set to D or R. Always release parking brake before starting to drive.

When you stop the vehicle, the parking brake must be engaged or a continuous audible alarm will sound if the Ignition Switch is in the S position (or OFF) and a door is open. Always set the parking brake before leaving the vehicle.

LIGHTS-ON REMINDER

If lights are ON and the key is turned to the OFF position, a beep will sound when any door is opened.

■ DRIVING YOUR ZENN

METERS AND GAUGES



SPEEDOMETER

The speedometer indicates the actual speed of the vehicle.



ODOMETER

The odometer records and displays the total distance the vehicle has been driven.

TRIP METER

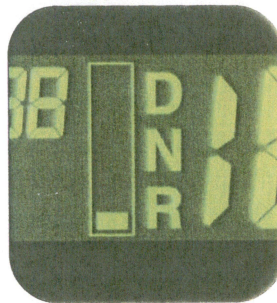
The trip meter's functions are as follows:

- The trip meter can record the total distance of one trip.
- The trip meter can record the distance from the point of origin.
- The trip meter records the accumulated distance the vehicle is driven until the meter is again reset.



Return it to 0.0 by holding the button to the right of the instrument and depress momentarily. Use this meter to measure trip distances and to compute your ZENN's energy consumption.

BATTERY STATE-OF-CHARGE



The battery state-of-charge shows approximately how much useful capacity remains in the battery pack.



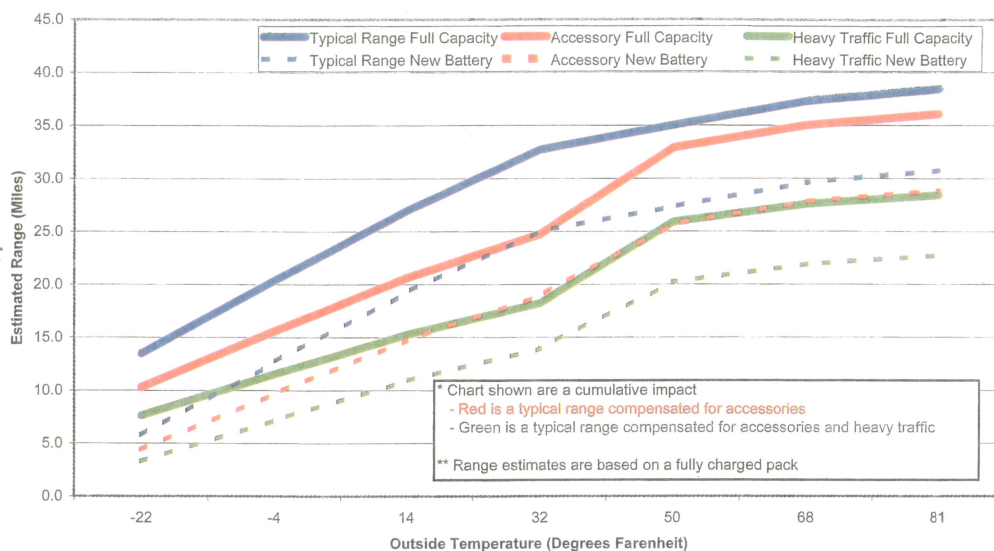
We recommend keeping the batteries fully charged when not in use.

Use Opportunity Charging whenever possible. Charge your battery pack even if you do not anticipate that you have time for a complete charge.

When the State-Of-Charge indicator flashes its last bar, recharge as soon as possible. It can take a few minutes for the state of charge indicator to recalculate when starting the vehicle. The state of charge may indicate a slightly higher charge status during this recalculation.

CARING FOR YOUR ZENN

- Batteries have a break-in period that requires a series of charging cycles for optimal performance. With the Discover EV31A-A battery, optimal performance can be achieved after only a few cycles.
- The ZENN comes equipped with peppy acceleration for good handling on the road. Hard acceleration will strain energy resources and it is recommended to ease up on acceleration whenever possible.
- The ZENN has many standard and optional accessories that are not available in competitive vehicles. Some of these include heater, windshield wipers, rear-window defrost, headlights, tail lights, power windows, door locks, radio, sunroof and air conditioning. Some of these accessories can impact battery life as additional power is required to utilize these features.
- Your battery indicator light on the instrument panel will let you know when a recharge is necessary. But it is always good to know other ways to check remaining power. If the vehicle seems sluggish (can't go above 20 mph) or if acceleration seems slow, plug in the ZENN for a full charge.
- When not in use, plug in the vehicle as often as possible to keep batteries topped up and warm. Charging for at least a full 8 hours is recommended.
- Cold weather can make the motor work harder. In fact, in 32 degrees Fahrenheit may impact the range of the vehicle as much as 50%. Heater usage, hilly terrain and stop and go driving can also impact range.
- See the following ZENN Range Guidelines.



■ MAINTENANCE AND CARE

OWNER MAINTENANCE OPERATION

Improper or incomplete service may result in problems. This section gives instructions only for items that are easy for ZENN owners to perform.

As explained in this chapter's Introduction, most procedures can be done only by a qualified service technician with special tools.

Improper owner maintenance during the warranty period may affect warranty coverage.

For details, read the ZENN Warranty which starts on page 44.

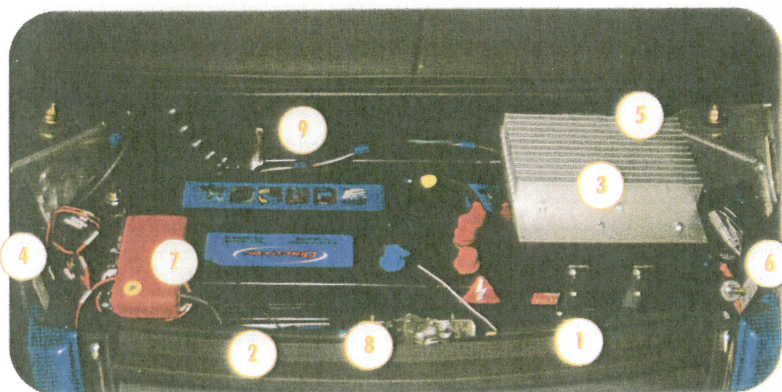
There are strict environmental laws regarding the disposal of waste batteries and fluids. Please dispose of your waste properly and with due regard to the environmental regulations in effect in your area.



Performing maintenance work on a vehicle is dangerous if not done properly. You can be seriously injured while performing some maintenance procedures.

Inspecting your ZENN with the service switch in the ON position is dangerous. Turn the Service Switch to the OFF position and remove the key from the Ignition Switch BEFORE performing an inspection of your ZENN.

DRIVE COMPARTMENT OVERVIEW



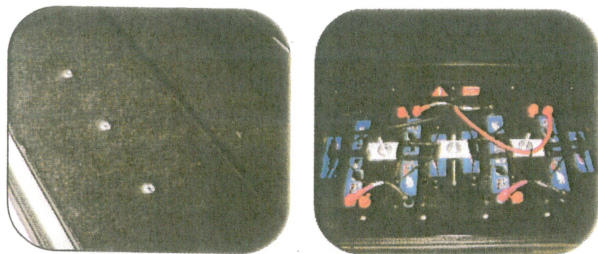
MOTOR AND CHARGER ARE HOT, DO NOT TOUCH

- | | |
|------------------------|--------------------------------------|
| 1. Charger | 6. Windshield washer fluid reservoir |
| 2. Motor Controller | 7. Fuse |
| 3. HVAC Controller | 8. Main Contactor |
| 4. DC-DC converter x 2 | 9. Air Conditioner |
| 5. Brake fluid level | |

REAR BATTERY BOX OVERVIEW

Before opening rear battery box, make sure the service switch is in the OFF position.

To access the rear battery box, you must use a T-55 torx wrench. Remove the three torx bolts and then the cover to gain access to the rear battery box.



BRAKE FLUID LEVEL

Inspect the fluid level in the reservoir regularly. It should be kept at MAX. The level normally drops with wear of brake lining. If it is excessively low, have the brake system inspected by an authorized ZENN retailer.



Spilled brake fluid is dangerous. If it gets in your eyes, they could be seriously injured. If this happens, immediately flush your eyes with water and get medical attention. Be careful not to spill brake fluid on yourself or on the electrical motor.



Low brake fluid levels are dangerous. Low levels could signal brake lining wear or a brake system leak. Your brakes could fail and cause an accident. If you find that the fluid level is low, have the complete brake system inspected.



Brake fluid will damage painted surfaces. If brake fluid gets on a painted surface, wipe it off immediately.

Using brake fluids different than the one specified (see page 3) will damage the system. Mixing different fluids can also cause damage. If the brake system frequently requires new fluid, have the complete brake system inspected by an authorized ZENN technician.

WASHER FLUID

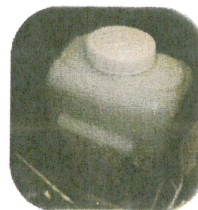
INSPECTING WASHER FLUID LEVEL



We strongly recommend using windshield washer fluid. Never use plain water in the reservoir unless there is no risk of freezing weather in the vehicle's driving area!

The top of the liquid should be between full and low. Use plain water if washer fluid is unavailable, but be aware of the risk of the fluid freezing in cold weather.

Front and rear washer fluid is supplied from the same reservoir:



MAINTENANCE AND CARE

BATTERY CHARGING



BATTERY-RELATED LEAD MATERIALS: Battery posts, terminals and related accessories contain lead and lead compounds, chemicals known to cause cancer and reproductive harm. Wash hands after handling.

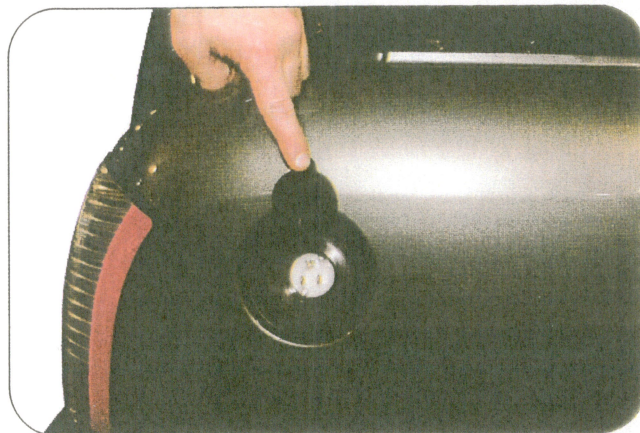
FOLLOW THESE PRECAUTIONS CAREFULLY: To ensure safe and correct handling of the battery, read the following precautions carefully before using the battery or inspecting it.

EYE PROTECTION: Working without eye protection is dangerous. Battery fluid contains SULFURIC ACID which could cause blindness if splashed into your eyes.

HYDROGEN GAS HAZARD: Hydrogen gas may be produced during a battery's operation. It could ignite and cause the battery to explode. Always wear eye protection when working near the battery. **NEVER SMOKE WHEN WORKING IN PROXIMITY OF BATTERIES.** Avoid all sources of ignition or sparks when working near freshly charged, charging, freshly discharged or discharging batteries. Sources of ignition include electrical tools, anything that can cause a spark, smoking, welding equipment, etc.

SPILLED BATTERY FLUID: Spilled battery fluid is dangerous. Battery fluid contains SULFURIC ACID which could cause serious injuries if it gets in eyes, on skin or clothing.

AVOID CONTACT with internal components if the battery is opened, broken or spilled.



The ZENN has a battery control and recharge system specially designed for electric vehicle usage. Four of the six 12-volt AGM batteries are located underneath the luggage compartment and two are located under the hood. The charging system is designed to maximize the battery pack life while recharging the pack in the shortest reasonable time with available household current (110-volt, 15 amp, A/C outlet). The following guidelines will ensure that you get the maximum battery life and performance out of your ZENN electric vehicle.

First use for a new set of batteries

Batteries should be fully charged before the first use. The premium AGM (Absorbed Glass Mat) batteries in your ZENN were selected to provide solid heavy duty performance with minimal owner maintenance. However, it is important to note that your batteries need to be "exercised" initially and will not perform to their fullest capacity until they have been discharged and recharged through multiple cycles. The number of discharge/recharge cycles to reach full capacity is dependent on many variables so it may be complete within a few charge cycles but depending on a variety of conditions such as temperature, depth of charge and usage patterns, it may require up to several additional charge cycles to fully exercise.

During USAGE

Batteries should be fully charged after each use. For current lead-acid battery technology, draining the batteries fully before recharging them is not appropriate, it will only shorten their service life and damage them. Use Opportunity Charging whenever possible.

Batteries should be charged in a well ventilated area at a temperature of less than 110° F (47° C).

Lead acid battery capacity is affected by cold weather and the range will be reduced. This is a normal characteristic of electric vehicles operating in the colder climates.

BATTERY CARE DURING Long-Term storage:

0 - 10 Days

You can store a fully-charged vehicle for up to 10 days, though some of the battery's power will dissipate. The ignition key should be in the OFF position.

10 days - 6 months

When storing a ZENN for periods longer than 10 days but less than six months, you can store the vehicle with the service switch in the ON position and the battery charger plugged in. The ZENN Charger will continuously monitor the state of battery's charge and will automatically start a charge cycle whenever the pack voltage falls below a certain charge level. Please note in areas where the power supply is below standard operating voltage or where frequent power outages occur, monthly monitoring is recommended.

In the event that leaving the charger plugged in is not possible or desired, then turn the service switch to the OFF position and arrange for periodic charging. Periodic charges should be conducted optimally every 14 days or no more than 30 days. Failure to follow these precautions will reduce the battery pack capability and life span.

■ MAINTENANCE AND CARE

BATTERY CHARGER

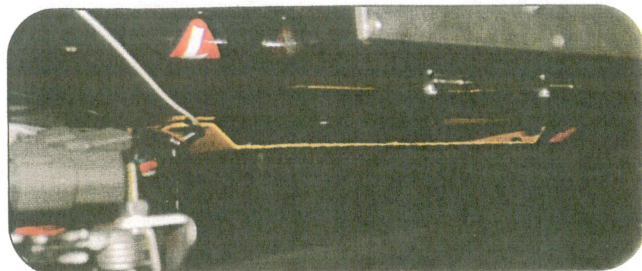
The battery charger receives 110 volt AC 15A power from an external standard grounded three-prong outlet and converts it to direct current (DC) power suitable for recharging the batteries (battery charge port, see page 10).

The battery charger only operates when a ZENN charger cord is plugged into your vehicle.

If the battery charger detects any presence of 110V AC power, your vehicle cannot be started or driven. This safety feature is to prevent damage to your extension cable, your ZENN and possibly your house.

If the last bar is flashing on the State-Of-Charge indicator, the battery pack should be put on charge as soon as possible.

A full recharge cycle from when the State-Of-Charge indicator is showing only one bar can take eight hours or more. Most recharge cycles will be shorter.



Recharge cycles are always encouraged. However, to condition a new set of batteries, it is recommended that you discharge the batteries down to at least two green bars (or less) for the first 10 - 20 trips.



Battery self-discharge increases in hot climates.

In cold climates, batteries will freeze if not properly charged.

Battery discharge will increase if the service switch is not turned to the OFF position when the vehicle is not used.



Do not touch the battery terminals with your hands or a metal object. Also, do not place any tools on the batteries. Never lay any tool or metal object across the top of the battery. This may inadvertently connect one battery terminal with another.

This vehicle contains a high voltage electrical system. Serious injury, death and/or property damage may result if this vehicle is not properly used, charged or serviced as stated in this manual. Read this owner's guide prior to use, charging, or servicing this vehicle.

Do not drill, cut, or modify any part of this vehicle, as high voltage wiring is present.

DO NOT USE JUMPER CABLES OR ATTEMPT TO JUMP-START THE VEHICLE.